

Appl. No. 09/753,226
Amdt. Dated 03/08/2005
Reply to Office Action of December 8, 2004

RECEIVED
CENTRAL FAX CENTER

MAR 08 2005

APPENDIX A

BEST AVAILABLE COPY

Understanding 802.11 Frame Types

Page 5

The World's Largest Wi-Fi Business Event

Wi-Fi VoWiFi

June 16-17, 2005
San Francisco, CA

FREE Symantec Technical Whitepapers and Tools:

Whitepaper: <u>The Need for Patch Management</u> Symantec Answers the Call	Informative Guide: <u>A Guide to Patch Management</u> by Rod Newing, a Leading IT Expert and Freelance Journalist	Whitepaper: <u>Symantec LiveState Recovery</u> Rapid and Reliable System and Data Recovery	Webcast: <u>Symantec LiveState</u> Webcast Address Recovery
--	--	---	--

internet.com

Illuminate reports:
Managing the IT
Process with HP.
Read about HP's
BladeSystem and
why these modular,
virtualized server
infrastructures are
the future of
enterprise
datacenters.

Microsoft
Protect.
» Find out more
Microsoft Office
Live Communications
Server 2005

Tutorials

Understanding 802.11 Frame Types By Jim Geler

When analyzing or troubleshooting the operation of a wireless LAN, you'll likely be using an 802.11 packet analyzer (e.g., AiroPeek or Sniffer Wireless) to monitor the communications between radio network interface cards (NICs) and access points. After capturing the packets, you need to understand the different 802.11

DISCO SYSTEMS CISCO MOBILITY FAST TRACK

Preparing for Wireless LANs

The article lays out the considerations for preparing an enterprise WLAN. Documenting user application and bandwidth requirements, choosing the appropriate technology and products, and completing a comprehensive site survey prior to installation will help you deploy a wireless network that meets or exceeds your company's -- and your users' -- greatest expectations. Included are a site survey checklist and sample of an "outside in" site survey method. Register to download.

Wireless LAN Security In Depth

This paper frames the WLAN implementation within the context of the overall security design. SAFE represents a system-based approach to security and VPN design. This type of approach focuses on overall design goals and translates those goals into specific configurations and topologies. In the context of wireless, Cisco recommends that you also consider network design elements such as mobility and quality of service (QoS) when deciding on an overall WLAN design. Register to download.

Capacity, Coverage, and Deployment Considerations for IEEE 802.11g

802.11g is an exciting new technology that offers additional performance, while providing investment protection for 802.11b clients through backward compatibility. By using previous technologies and economies of scale, 802.11g devices are available at little or no additional cost relative to 802.11b. As

Small Business Computing.com
Your Online Guide to Small-Business Technology
Your online resource for
Product Reviews,
E-commerce & Marketing Tools,
Buyers' Guides,
& Tutorials.
Small Business Computing.com
Essential Wi-Fi Research
Now Available!
802.11 Wireless LAN
Security, Usage
Expectations, & Strategies for

<http://www.wi-fiplanet.com/tutorials/article.php/1447501>


2/28/2005

Understanding 802.11 Frame Types

Page 1 of 5

The Future
More Research

Subscribe Now!
Wi-Fi Planet.com's Daily
Newsletter

☒ html ☐ text
your-email-address

More Free Newsletters

Wi-Fi Glossary
Find a Wi-Fi Term



Wi-Fi® is a
registered
certification mark of
the Wi-Fi Alliance

Internet Commerce
B2B Commerce Partner
Online Degrees
Desktop Computers
Managed Hosting
Search Engine Ranking
Cell Phone Plans
Send Flowers
Calling Cards
Cheap Airline Tickets
DVD Players
Computer Accessories
Information
Phone Systems

Internet.com
Developer
Downloads
International
Internet Lists
Internet News
Internet Resources
IT
Linux/Open Source
Personal Technology
Small Business
Windows Technology
ASP Resources

Search Internet.com
Advertise
Corporate Info
Newsletters
Tech Jobs
E-mail Offers

frame types as a
basis for
deciphering what
the network is or
isn't doing. In this
tutorial, I'll give
you an overview
of the more
common 802.11
frames to help
you become more
adept at
comprehending
the operation of a
wireless LAN
and solving
network
problems.

General frame concepts

The 802.11
standard defines
various frame
types that stations
(NICs and access
points) use for
communications,
as well as managing and controlling the wireless link. Every frame has a
control field that depicts the 802.11 protocol version, frame type, and
various indicators, such as whether WEP is on, power management is
active, and so on. In addition all frames contain MAC addresses of the
source and destination station (and access point), a frame sequence number,
frame body and frame check sequence (for error detection).

802.11 data frames carry protocols and data from higher layers within the
frame body. A data frame, for example, could be carrying the HTML code
from a Web page (complete with TCP/IP headers) that the user is viewing.
Other frames that stations use for management and control carry specific
information regarding the wireless link in the frame body. For example, a
beacon's frame body contains the service set identifier (SSID), timestamp,
and other pertinent information regarding the access point.

Note: For more details regarding 802.11 frame structure and usage, refer to
the 802.11 standard, which is free for download from the [802.11 Working
Group Web site](#).

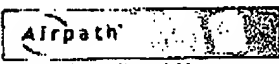
Management Frames

such, there are many reasons to begin migrating from 802.11b
to 802.11g. [Register to download.](#)

Radio Management for Effective WLAN Deployment, Operations, and Security

Explore how to use radio management--a feature of the ~~802.11~~
Structured Wireless-Aware Network (SWAN)--to easily and
effectively deploy, operate, and manage a secure wireless
network. In this audiocast, hear the experts discuss how ~~802.11~~
LAN (WLAN) radio management can help you better detect
malicious or employee rogue access points, detect interference,
perform site surveys, and manage daily WLAN operations.
[Register to download.](#)

>> Wi-Fi Planet Marketplace


Wireless broadband Management
solution

**Detect RF
Interference** 
BVS Handheld
Spectrum Analyzer

RELATED ARTICLES

[802.11 Alphabet Soup](#)

[Beating Signal Loss in WLANs](#)

[FIRP Limitations for 802.11 WLANs](#)

Understanding 802.11 Frame Types

Page 1 of 5

802.11 management frames enable stations to establish and maintain communications. The following are common 802.11 management frame subtypes:

- **Authentication frame:** 802.11 authentication is a process whereby the access point either accepts or rejects the identity of a radio NIC. The NIC begins the process by sending an authentication frame containing its identity to the access point. With open system authentication (the default), the radio NIC sends only one authentication frame, and the access point responds with an authentication frame as a response indicating acceptance (or rejection). With the optional shared key authentication, the radio NIC sends an initial authentication frame, and the access point responds with an authentication frame containing challenge text. The radio NIC must send an encrypted version of the challenge text (using its WEP key) in an authentication frame back to the access point. The access point ensures that the radio NIC has the correct WEP key (which is the basis for authentication) by seeing whether the challenge text recovered after decryption is the same that was sent previously. Based on the results of this comparison, the access point replies to the radio NIC with an authentication frame signifying the result of authentication.
- **Deauthentication frame:** A station sends a deauthentication frame to another station if it wishes to terminate secure communications.
- **Association request frame:** 802.11 association enables the access point to allocate resources for and synchronize with a radio NIC. A NIC begins the association process by sending an association request to an access point. This frame carries information about the NIC (e.g., supported data rates) and the SSID of the network it wishes to associate with. After receiving the association request, the access point considers associating with the NIC, and (if accepted) reserves memory space and establishes an association ID for the NIC.
- **Association response frame:** An access point sends an association response frame containing an acceptance or rejection notice to the radio NIC requesting association. If the access point accepts the radio NIC, the frame includes information regarding the association, such as association ID and supported data rates. If the outcome of the association is positive, the radio NIC can utilize the access point to communicate with other NICs on the network and systems on the distribution (i.e., Ethernet) side of the access point.
- **Reassociation request frame:** If a radio NIC roams away from the currently associated access point and finds another access point having a stronger beacon signal, the radio NIC will send a reassociation frame to the new access point. The new access point then coordinates the forwarding of data frames that may still be in the buffer of the previous access point waiting for transmission to the radio NIC.

Understanding 802.11 Frame Types

Page 4 of 5

- **Reassociation response frame:** An access point sends a reassociation response frame containing an acceptance or rejection notice to the radio NIC requesting reassociation. Similar to the association process, the frame includes information regarding the association, such as association ID and supported data rates.
- **Disassociation frame:** A station sends a disassociation frame to another station if it wishes to terminate the association. For example, a radio NIC that is shut down gracefully can send a disassociation frame to alert the access point that the NIC is powering off. The access point can then relinquish memory allocations and remove the radio NIC from the association table.
- **Beacon frame:** The access point periodically sends a beacon frame to announce its presence and relay information, such as timestamp, SSID, and other parameters regarding the access point to radio NICs that are within range. Radio NICs continually scan all 802.11 radio channels and listen to beacons as the basis for choosing which access point is best to associate with.
- **Probe request frame:** A station sends a probe request frame when it needs to obtain information from another station. For example, a radio NIC would send a probe request to determine which access points are within range.
- **Probe response frame:** A station will respond with a probe response frame, containing capability information, supported data rates, etc., when after it receives a probe request frame.

Control Frames

802.11 control frames assist in the delivery of data frames between stations. The following are common 802.11 control frame subtypes:

- **Request to Send (RTS) frame:** The RTS/CTS function is optional and reduces frame collisions present when hidden stations have associations with the same access point. A station sends a RTS frame to another station as the first phase of a two-way handshake necessary before sending a data frame.
- **Clear to Send (CTS) frame:** A station responds to a RTS with a CTS frame, providing clearance for the requesting station to send a data frame. The CTS includes a time value that causes all other stations (including hidden stations) to hold off transmission of frames for a time period necessary for the requesting station to send its frame. This minimizes collisions among hidden stations, which can result in higher throughput if you implement it properly.
- **Acknowledgement (ACK) frame:** After receiving a data frame, the receiving station will utilize an error checking processes to detect the

presence of errors. The receiving station will send an ACK frame to the sending station if no errors are found. If the sending station doesn't receive an ACK after a period of time, the sending station will retransmit the frame.

Data Frames

Of course the main purpose of having a wireless LAN is to transport data. 802.11 defines a data frame type that carries packets from higher layers, such as web pages, printer control data, etc., within the body of the frame. When viewing 802.11 data frames with a packet analyzer, you can generally observe the contents of the frame body to see what packets that the 802.11 data frames are transporting.

Jim Geier provides independent consulting services to companies developing and deploying wireless network solutions. He is the author of the book, Wireless LANs (SAMS, 2001), and regularly instructs workshops on wireless LANs. Join Jim for discussions as he answers questions in the 802.11 Planet Forums.

August 15, 2002

RELATED ARTICLES

[802.11 Alphabet Soup](#)

[Beating Signal Loss in WLANs](#)

[EIRP Limitations for 802.11 WLANs](#)



Email this article to a colleague



Go to a printable version of this story

How much money
are companies saving
with IT outsourcing?

Click here for the answer

 **Jupiterrese**
Business Intelligence for Busin

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.